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ABSTRACT

The purpose of the study is to evaluate the influence of qualitative cognitive differences (cognitive style) as a mediator between environmental circumstances (including ethnicity) and achievement measures. The concept of cognitive style is examined, particularly as it relates to school achievement differences between different sub-population groups. Literature which discusses the relationship between demographic variables such as race, sex, ethnic background and socioeconomic status is summarized. This literature is then expanded upon and applied, along with the concept of cognitive style, in comparing school achievement differences of Maori and Pakeha children from similar environmental circumstances in New Zealand. Hypotheses derived from the literature surveyed are tested against data collected for the Maori-Pakeha study. Findings are presented in comparative tables and discussed, and a copy of a cognitive style test is appended. It is suggested that the influence of school environments on preferred modes of cognition is probably strong enough to overcome any differences arising from socialization due to ethnicity. (Author/EB)

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Cognitive Style, Environment and School Achievement:

A Cross-Cultural Study

Richard K. Harker

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Introduction

The education of Maori children has been a topic of considerable interest and debate amongst New Zealand educationalists for many years. The extent of academic achievement differences between Maori and Pakeha pupils are reviewed elsewhere (Harker, 1973) and will not be elaborated here. The purpose of the study reported in this monograph is to evaluate the influence of qualitative cognitive difference (cognitive style)as a mediator between environmental circumstances (including ethnicity) and achievement measures.

The predicating of a mediating role for cognitive style, presupposes that the schools operate within the bounds of one particular or dominant style, and children do more or less well within the cognitive environment of the school depending upon the extent to which the cognitive style into which they have been socialised is congruent with the style fostered by the school.

These concerns derive from two distinct sources: first, New Zealand writing on the 'educationally disadvantaged' and Maori education - two issues often treated as synonymous in the literature; and second, the literature, deriving mainly from American studies, which suggests that one of the main effects of different environmental circumstances is on the cognitive style into which the children are socialised as a means of comprehending the world around them.

The first of these sources has been elaborated elsewhere (Harker, 1976), and the focus of this monograph will be confined to the second source, the concept of cognitive style itself, and the way in which a particular measure of cognitive style interacts with ethnicity, selected environmental variables and attainment.

Cognitive Style

In this section, the concept of Cognitive Style will be examined, particularly as it relates to school achievement differences between different sub-population groups. The relevance of the concept for explaining Maori-Pakeha differences will also be considered as a theoretical proposition, and a number of hypotheses will be generated to test the explanatory power of a measure of Cognitive Style.

Nathan Kogan (1971: 244) has defined cognitive style as:

> "... individual variation in *modes* (sic) of perceiving, remembering, and thinking, or as distinctive ways of apprehending, storing, transforming and utilizing information. It may be noted that *abilities* (sic) also involve the foregoing properties, but a difference in emphasis should be noted: Abilities concern level of skill - the more and less of performance - whereas cognitive styles give greater weight to the *manner* and *form* (sic) of cognition."

He thus makes the important distinction between the quantitative measure of cognition (which Hertzig (1971: 149) calls cognitive competence), and the qualitative nature of the cognitive processes involved. Educational practice has been very much concerned with the quantitative aspects of cognition in children, and teaching methods together with remedial measures have been based on the proposition that the school's function is to increase the level and efficiency of a child's cognitive abilities. Kogan suggests (1971: 243) that it is only in the last decade or so that there has been any attempt to articulate educational research on the qualitative aspects of cognition. Furthermore, the cognitive style variable is an important source of individual differences in school achievement which overlays the obvious demographic variables such as race, sex, ethnic background and socio-economic status. The literature which discusses the relationship between these 'demographic variables' and

cognition will be taken up again after the concept of cognitive style itself has been examined further.

Definitive statements on the development of the concept of cognitive style within the general psychological literature are to be found, inter alia, in Kagan and Kogan (1970) and Vernon (1973). From these sources it is apparent that the study of cognition, until the last decade or so, has been the almost exclusive preserve of experimental and theoretical psychology. Kogan (1971: 244) outlines three major developments which have served to bring the field of cognitive studies generally, to the attention of educationists: first, many psychologists have taken up the study of cognitive processes in ways that can contribute to the understanding of educational issues and problems; secondly, the increasing interest in developmental studies of cognitive processes (stemming largely from the work of Piaget), which has obvious educational implications since they force consideration of the extent of the match between developmental stages and the content and method of instruction for children in the various stages of development; and thirdly, an increasing interest in the interaction between individual cognitive and non-cognitive characteristics and task and instructional variables.

It is the third development which is relevant to the purpose of this study, since the study will be concerned with the relationships between a non-cognitive characteristic such as ethnicity, cognitive style, and task performance on selected achievement measures. In this context, Bruner, Goodnow & Austin (1956) tie cognition much more explicitly to cultural variables when they state:

> "...all cognitive activity depends upon a prior placing of events in terms of their category membership... A category is, simply, a range of discriminably different events that are treated 'as if' equivalent... category learning is one of the principal means by which a growing member of a society is socialized, for the categories that one is taught and comes to use habitually reflect the demands of the culture in which they arise." (Bruner et al, 1956: 231-232)

Hence Bruner, Goodnow & Austin place strong emphasis on categorizing behaviour as the fundamental building block of cognitive activity. Qualitative differences in cognitive behaviour, for these authors would involve different modes of categorisation, whereas quantitative differences would involve greater or less competence and complexity within one mode. Other ways of defining qualitative differences in cognition may also be found in the literature. Kogan, drawing on the work of Messick (1970), has summarised the various phenomena that are generally subsumable under the heading of qualitative aspects of cognition, and which are termed in the literature 'styles', 'controls', 'strategies', and 'information processing habits':

> "1. Field independence vs. field dependence: an analytical, in contrast to a global, way of perceiving (which) entails a tendency to experience items as discrete from their backgrounds and reflects ability to overcome the influence of an embedding context.
>
> 2. Scanning: a dimension of individual differences in the extensiveness and intensity of attention deployment, leading to individual variations in the vividness of experience and the span of awareness.
>
> 3. Breadth of categorizing: consistent preferences for broad inclusiveness, as opposed to narrow exclusiveness, in establishing the acceptable range for specified categories.
>
> 4. Conceptualizing styles: individual differences in the tendency to categorize perceived similarities and differences among stimuli in terms of many differentiated concepts, which is a dimension called conceptual

differentiation, as well as consistencies in the utilization of particular conceptualizing approaches as bases for forming concepts (such as the routine use in concept formation of thematic or functional relations among stimuli as opposed to the analysis of descriptive attributes or the inference of class membership).

5. Cognitive complexity vs. simplicity: individual differences in the tendency to construe the world, and particularly the world of social behavior, in a multi-dimensional and discriminating way.

6. Reflectiveness vs. impulsivity: individual consistencies in the speed with which hypotheses are selected and information processed, with impulsive subjects tending to offer the first answer that occurs to them, even though it is frequently incorrect, and reflective subjects tending to ponder various possibilities before deciding.

7. Leveling vs. sharpening: reliable individual variations in assimilation in memory. Subjects at the leveling extreme tend to blur similar memories and to merge perceived objects or events with similar but not identical events recalled from previous experience. Sharpeners, at the other extreme, are less prone to confuse similar objects and, by contrast, may even judge the present to be less similar to the past than is actually the case.

8. Constricted vs. flexible control: individual differences in susceptibility to distraction and cognitive interference.

9. Tolerance for incongruous or unrealistic experiences: a dimension of differential willingness to accept perceptions at variance with conventional experience." (Kogan, 1971: 244)

In addition to the nine styles mentioned by Messick, Kogan would add 'risk-taking vs. cautiousness' which has both cognitive and motivational aspects.

The behaviours listed here as 'styles' are different on a number of counts, the main one of which would be their theoretical antecedents. They also vary in the extent to which they have been tested and refined, and in the extent to which their linkages to education have been explicated theoretically or empirically. The two most thoroughly researched areas are those listed above as 1. and 4. The field independence vs. field dependence areas has been the concern of Witkin and his associates (Witkin et al, 1962) for over two decades and is perhaps more concerned with perceptual skills than with cognition per se. The area listed as 4. by Kogan has arisen from the work of Kagan, Moss & Sigel (1960, 1963), and has been directed more specifically to exploring relationships between their conceptualising styles, school achievement and intelligence. It is also the area most directly concerned with Bruner, Goodnow & Austin's placing of categorising behaviour to the forefront when considering cognitive activity (Bruner et al, 1956). Lenneberg (1967) and Nelson (1973) echo Bruner et al, and lend further strong support to the primacy of categorization in cognitive development. "Concepts... are not so much the product of man's cognition, but conceptualization is the *cognitive process itself*". (Lenneberg, 1967: 332-333). Kagan et al (1963) noted parallels between their conceptual style model and the field dependence - field independence model of Witkin et al (1962), however Witkin himself is very cautious about the comparability of the two models, despite some apparent similarities (Witkin, 1963). Messick & Fritzky (1963) attempted to investigate empirically the relationship between the Kagan and Witkin models and showed only marginal correlations. A more comprehensive study by Wachtel (1968) found that having a field independent score on Witkin's Embedded Figures Test reflects primarily an analytic capacity, whereas the production of analytic groupings on a sorting task (such as Kagan et al Conceptual Style Test) reflected primarily a stylistic preference. This stylistic preference relates back to the habitual use of culturally induced modes of categorization

mentioned by Bruner, Goodnow & Austin (1956: 232). The implication is that stylistic *preference* in categorization is much more likely to vary across cultural boundaries than the ability to *form* conceptual categories per se.

For these reasons attention will be focussed on the Kagan et al (1963) notion of Conceptualizing styles, for the purposes of this cross-cultural study, and when the term 'cognitive style' is used subsequently, it can be taken to mean conceptual style in the sense that Kagan et al define it. In working up their notion of cognitive style, two different assessment procedures were used: first, a sorting task using a variety of human figures, the assessment being based upon the criteria used in the sorting; secondly, specifically designed for children, a task in which pictorial stimuli are presented in triads, requiring the selection of two out of the three stimuli deemed to be most similar, the criterion used for selection being noted. On the basis of these assessment procedures, Kagan, Moss & Sigel proposed a three fold distinction for conceptual classification as follows:

1. Descriptive (later analytic-descriptive, and later still simply analytic).

> "This category includes concepts that are based on similarity in objective elements, within a stimulus complex, that were part of the total stimulus. The S. selects an element of objective similarity shared by two or more figures that is a differentiated part of the total stimulus. Moreover, the conceptual label adopted by the S. contains a reference to the objective attribute shared by the grouped stimuli." (Kagan, Moss & Sigel, 1963: 76)

For example, with item 1 of the Cognitive Style Test used in this study (see Appendix 1) where the child is presented with line drawings of a man, a wrist-watch and a ruler, and is asked to nominate which two belong together, the response would be defined as analytic when the child says that the watch and the ruler go together because they both have number on them.

2. Inferential-categorical

> "This category includes concepts that are not directly based on a partial objective attribute of the stimuli, but involve an inference about the stimuli grouped together. Moreover, in an inferential concept, as in a descriptive one, any stimulus in the group is an independent instance of the conceptual label." (Ibid)

Using the same stimulus item as above, an inferential-categorical response would be recorded when the child responded that the watch and the ruler belonged together because they both measure things, or they both are instruments.

3. Relational

> "This category includes concepts that are based on a functional relationship between or among the stimuli grouped together. This functional relationship can involve temporal or spatial contiguity between objects or interobject relationships among the stimulus members. In this category no stimulus is an independent instance of the concept, and each stimulus depends for its membership on its relationship to the other stimuli in the group." (Ibid)

Again using the same stimulus item, a response would be coded relational if the child responded that the man and the watch went together because the man wears the watch, or the watch goes on the man's arm.

Kagan and his associates conducted a series of studies exploring the relationship between these conceptual categories and a variety of other behavioural phenomena, the most germane for cognitive development being the findings related to intelligence. Table 1 is

Table 1

Data from Table 2 of Kagan, Moss & Sigel (1963: 86)

Correlations Between Scores in Each of the Conceptual Categories and the Sub-Test and Total Scores from the California Test of Mental Maturity.

CTMM	Analytic		Categorial		Relational	
	boys	girls	boys	girls	boys	girls
Verbal IQ	.07	.20	.57**	.31	-.30	-.36*
Non-V. IQ	.42**	.26	.47**	.25	-.51**	-.26
Total IQ	.24	.14	.72**	.42**	-.48**	-.35*

(* Significant at .05 level; ** Significant at .01 level)

taken from Table 2 of Kagan, Moss & Sigel (1963: 86), and shows the correlations between frequency of responses in the various conceptual classifications and measures of intelligence from the California Test of Mental Maturity.

> "The correlations between conceptual approach and scores on the California Test of Mental Maturity support the notion that an analytic attitude is more closely related to performance on items requiring perceptual differentiation than to facility on questions assessing language skills. There was no relation for boys between an analytic attitude on the conceptual style test and mental status on the verbal half of the California test ($r = +.07$). The items making up this score include vocabulary, verbal arithmetic problems, verbal reasoning, and memory for story elements. However, the non-language score was moderately correlated with analytic concepts in boys ($r = +.42$; $p < .05$). This score is based on tests of comprehension of spatial relationships, mazes, and reasoning tests that involve visually presented materials rather than language. A non-analytic approach was associated with poor performance on the non-language scale ($r = -.51$; $p < .05$). Only inferential concepts showed a high, positive correlation with the langugage score ($r = +.57$; $p < .01$), supporting the popular opinion that verbal items on standard I.Q. tests assess, in large measure, the degree to which the child has acquired the conventional abstract labels of his language." (Ibid)

A more recent study by Gray & Knief (1975) specifically explored the relationships between cognitive style (measured on a modified version of the Kagan, Moss & Sigel instrument, together with some items from a subsequent modification by Sigel (1967)), and school achievement amongst fifth graders in an American south-western city school district. Fifth graders in the American system are in the same age range as Standard three pupils in New Zealand schools, the group used in the present study. Gray & Knief found rather weaker relationships between their cognitive style measures and their I.Q. measures (from the Lorge-Thorndike Intelligence Test). These were in line with the weak to non-existent relationships between cognitive style and school achievement measures as shown in Table 2. In their findings however, the analytic (descriptive in their Table) mode does seem to have a consistent - though weak - positive correlation with both intelligence and school achievement, while the relational style has a consistently weak negative association. From the Gray & Knief data it is also clear that the analytic style is bipolar with respect to both relational and categorical modes, with no relationship between the relational and categorical modes (p. 68). These data, then provide a basis against which data from New Zealand children of the same age may be compared

Table 2

Data from Table 2, Gray & Knief (1975: 69)

Intercorrelations of Variables Used in the Gray & Knief Study.

Variable	2	3	4	5	6	7	8
1 Categorical	-.55*	-.01	-.04	.04	.00	-.03	.02
2 Descriptive		-.37*	.18*	.14*	.17*	.13*	.13*
3 Relational			-.10	-.17*	-.15*	-.09	-.11
4 Verbal IQ				.71*	.92*	.85*	.72*
5 Non-Verbal IQ					.93*	.60*	.70*
6 Full Scale IQ						.77*	.77*
7 Reading							.74*
8 Mathematics							

(* Significant at .05 level)

as some indication of the universality and stability of the cognitive style concept as used in this study.

Further studies related to school achievement by Kagan and his associates (Kagan et al, 1964), together with the work of other researchers (Sigel, Jarman & Hanesian, 1967; Cohen, 1968, 1969) suggest that the child who generates analytic concepts has an advantage in the classroom context over a child who generates relational ones, as is apparent in the Gray & Knief data. As an illustration of this important finding, the work of Cohen (1968, 1969) is germane.

Cohen explored the conceptual features of American schools by undertaking a content analysis of the most commonly used standardised tests of intelligence and achievement. This procedure yielded three major factors underlying successful performance.

"They were:

1. breadth and depth of informational content,
2. the ability to abstract analytically, and
3. the ability to extract salient information from its embedding contexts (field articulation)."

(Cohen, 1968: 202; 1969: 828-829)

As noted above, there are three cognitive styles which individuals may use in a given stimulus situation when selecting information salient to them. But, according to Cohen, schools require one specific approach to cognitive organisation - analytic - so that ability (or preference) in using this mode becomes increasingly critical the higher up the educational ladder one moves.* This raises the question of causation. Why do some children prefer relational responses to analytic ones? Some children do not have the ability to make analytic

* Cohen abandoned the categorical response mode in her study, in favour of a straight analytic-relational dichotomy. Responses which originally would have been coded as categorical were assigned to either analytic or relational modes depending on whether the response was 'stimulus centred' (analytic), or 'self-centred' (relational).
(Cohen, 1969: 829-830 and Appendix C).

responses, but according to Wachtel (1968) as noted above, this conclusion may not be drawn from a test such as that which Kagan et al utilize. Here we are dealing with a *preference* for a particular mode of response, rather than a skill which a child has or has not got available to him. Hence in trying to find reasons for one kind of response rather than another, unless the condition is genetic, which seems unlikely, it would appear to be necessary to look for extra-individual circumstances which predispose toward particular kinds of responses . It should be borne in mind that qualitative differences are being examined here, rather than the more usual quantitative ones which seek to measure the extent to which a child has mastered a particular ability. Sigel (1968: 509), echoing Bruner, Goodnow & Austin (1956), notes that a focus on experiential factors implies a conviction that sources of variation in performance reside in extra-individual variables. Thus if the nature of these extra-individual variables is known, obtained differences amongst groups of children can be accounted for. Interwoven with the extra-individual variables is the personality structure of the individual. It is interwoven, because personality is to a considerable extent determined by experience, and also plays an influential role in determining *how* the child will interact with the environment. However, irrespective of his personality, the specifics of the environment, as determined by culture and the availability of resources, contribute to the quality of the child's contact and the content of his experiences (Sigel, 1968: 510). The content and range of these experiences bear a fairly straightforward relationship to the availability of resources which the environment provides. In this regard, Sigel (Ibid) compares rural and urban areas as offering quite different arrays of experiences as a function of the different kinds of resources available within the particular environments classified as rural or urban. Similarly, he suggests, the nature of the economy in which the child's family participates (whether it be a highly industrialised, technological community, or a technologically underdeveloped, largely agrarian community) will affect the availability of resources and the arrays of experiences to which the child is exposed. In New Zealand, a rural-urban dichotomy would also reflect some economic differences, with the rural child being exposed to a wider, more integrated and whole economy, where the various features of the man-made landscape can be related to the occupational activities of the community, such as farming or timber-milling. The urban child, on the other hand, would not experience such integration, the various aspects of the urban landscape being perceived in a much more fragmentary way not readily cognizable as integrated. Hence, support for the relevance of Sigel's contention to New Zealand school children would necessitate finding significant differences in preferred mode of response on the cognitive style test, between those attending rural schools and those attending urban ones (see Hypotheses 4, 5 and 6).

As noted above, Sigel suggests that any direct relationship between environmental opportunities and preferred cognitive modes will be mediated by personality factors. He states that:

> "... the personality structure interacting with the environmental opportunities contributes considerably to the quality and pattern of children's thought."

Two major aspects or determinants of personality which are of significance for the present study are the influence of culture on the personality structure,* and the influence of sex-role expectations, both between cultural groups and within cultural groups. These two consideration would suggest (if valid) that any rural-urban differences found on the cognitive style test would need to be looked at *within* each of the cultural groups concerned, and for boys and girls separately for the sample as a whole, and within each cultural group.

---

* Personality is likely to have a much greater influence on stylistic *preference* than on the *ability* to make analytic judgements, hence needs to be borne in mind as a possible explanation if ethnic differences in stylistic preference persist after controlling for environmental factors, on the Kagan et al Cognitive Style Test.

Over and above rural-urban differences, and the availability of resources, it is necessary to consider other ways in which *culture* determines "... the specifics of the environment" (Sigel, 1968: 510), and which of these specifics are significant for cognitive development. Herskovits (1955: 305) has defined culture as "... the man-made part of the human environment". Such an encompassing definition subsumes not only the material aspects of the man-made environment but also its conceptual and symbolic features such as the values, norms, beliefs, myths, religions, laws and epistemological system which are held by a group of people. It is these latter, non-material features of culture which are most likely to affect people's behaviour and the kind of cognitive mode in which they prefer to operate. If these features vary from group to group, the cumulative effect on the environment (particularly the cognitive environment) in which children are reared is likely to be widespread, affecting the attitudes, beliefs and values which the children come to acquire through socialisation.

Such variables are of little consequence for children who are going to live out their lives in the same environmental circumstances as the adults who socialise them. However, in a multi-cultural society undergoing rapid economic and social change, these variables can be seen to be crucial in determining life-chances in the wider national society, more particularly so if that society has a single-track education system, geared to facilitate social and economic change to which minority cultural groups are not orientated. Such school systems develop their own cultures which have their own set of values, beliefs and so on. Hence the idea of culture conflict can readily be invoked, not only to describe misunderstandings between societies, but also within a society to describe the difficulties met with in schools by children from different cultural or sub-cultural groups (Cohen, 1969).

The culture that schools develop will have its own particular features, which in turn will have their part to play with regard to cognitive development. The relationship between the culture of the school and cognitive style is explicated by Cohen, and manifests itself in a number of contexts:

> "... not only test criteria but also the overall ideology and learning environment of the school embody requirements for many social and psychological correlates of the analytic style. This emphasis can be found, for example, in its cool, impersonal, outer centred approach to reality organisation. Analytic correlates can also be found in the requirements that the pupil learn to sit increasingly long periods of time, to concentrate alone on impersonal learning stimuli, and to observe and value organised time-allotment schedules." (Cohen, 1969: 830).

This claim of Cohen's, for an analytic orientation of the school, has important consequences for the pupil whose preferred mode of cognitive organisation is other than analytic. Such a child

> "... is unlikely to be rewarded in the school setting either socially or by grades, regardless of his native abilities and even if his information repertoire and background of experience are adequate." (Ibid)

Cohen also found that the analytic cognitive style was not normally distributed among pupils. Few pupils from low-income environments used the analytic mode, while this mode was dominant among middle-class pupils.

> "The absence of normal distributions of these characteristics suggests that such systematic variations may have arisen as a result of different social environments that stimulate, reinforce and make functional the development of one style of conceptual organisation and constrain and inhibit others." (Ibid)

In following this proposition through, Cohen found that the organisational style of family and friendship groups in the low income areas she studied, were different from typical

middle-class methods of primary group organisation, and strongly related to the cognitive styles of their members. In such low income groups, regardless of ethnic differences, critical functions such as leadership, child care and the discretionary use of group funds are not assigned to status roles within the group. Instead, such functions are periodically performed or widely shared by all members of the group. Where a child was socialised in such a 'shared-function' environment, it was found to be highly unlikely that he would develop any facility with the analytic cognitive style, and moreover, would not be able to participate effectively in any aspect of the formal school environment. Cohen, then, has isolated a social organisational variable that appears to have some potential significance for the development of cognitive style, and which in her data is independent of ethnic group membership.

To apply these findings to New Zealand, and more specifically, to estimate their significance in explaining Maori-Pakeha achievement differences, would require significant relationships to be found between frequency of responses in the three modes of response on the cognitive style test, and socio-economic status. If Cohen's findings are to be fully supported, these relationships would need to be the same within both the Maori and Pakeha groups.

While the work of Cohen would seem to give primacy to socio-economic status, and an insignificant (or at least secondary) role to ethnicity as determiners of preferred mode of cognitive response, other researchers, working in the field of patterns of achievement, present a different ordering of these two variables. Lesser and his associates (Lesser, Fifer & Clark (1965); Stodolsky & Lesser (1967)) compared the patterns of achievement in children from different class and ethnic backgrounds in New York, and found that, although lower class children tend to perform at a lower level than middle class children on all tasks, the hierarchical organisation of verbal, arithmetic, and reasoning skills, as well as the ability to conceptualise spacial relations, appeared to depend on ethnicity, and remained the same for children of the same ethnic background independent of their social class. In this case the culturally determined pattern of cognitive abilities was associated within each ethnic group with different achievement levels, which derived from the social class background. Their findings suggest that some qualitative aspects of cognition are culturally determined (through ethnic group membership), while quantitative aspects within any particular cognitive domain are determined by socio-economic circumstances.

Other studies have generally supported the findings of the Lesser group. For example, Marjoribanks (1972) examined the ability patterns of five ethnic groups residing in Canada, and demonstrated strikingly similar ability profiles to those of the Lesser, Fifer & Clark (1965) study, for those groups that were common to both studies. In addition, Marjoribanks found that by extending his environmental variables beyond the standard measures of socio-economic status, he was able to reduce the ability profile differences between the ethnic groups he used. In the domain of cognitive development, Feldman (1969), who studied 270 Black, Chinese and White subjects at various grade levels and matched for socio-economic status, found evidence to support the proposition that each of the ethnic groups had a unique rate and sequence of cognitive development.

A study which examined the relationship between ethnic group membership and Witkin's field-dependent-independent dimension of cognitive style (which, it has been noted above, may reflect an analytic ability rather than a preference for the analytic mode) was undertaken by Dershowitz (1966). The results from his sample of 50 Jewish and 30 White boys, confirmed his major hypothesis that:

> "The patterns involved in the field-dependence-independence continuum are affected by specific cultural determinants, and differ from group to group in accord with selective cultural pressures." (Dershowitz, 1966: 92)

He concluded that the differences observed in his data were not limited to content, but extended to the way in which the environment was perceived, and that this difference diminished as the strength of ethnic identity diminished.

Some support for certain aspects of the Lesser et al findings in the New Zealand setting is to be found in a study by Brooks (1973). His research on four-year-old Maori and Pakeha children shows that different cultures produce different patterns of sex differences in abilities, but overall concluded "... that differences in test performance are greater between SES groups than between cultural groups (Maori and Pakeha)", particularly for non-verbal tests. Further evidence is to be found in the study of New Zealand youths by Chapman (1973). He showed no significant difference between Maori and Pakeha adolescent males on the Witkin field-dependence-independence dimension, despite an expectation of greater field dependence amongst the Maori youths based on the greater degree of dependence which, according to J. & J. Ritchie (1968), characterises Maori personality patterns, together with an orientation to others. As Chapman points out (p. 43), it may be true that orientation to others reflects a lack of independence, but it might, on the other hand, simply reflect a different set of goals and values.

> "So the Maori, though less concerned with individualism, may be as analytic in thought and perception as the Pakeha, but his thought is directed more toward interpersonal rather than occupational or academic goals." (Chapman, 1973: 43)

As noted above (see also Wachtel, 1968), the Witkin field-dependence-independence dimension is more a test to measure the extent of an analytic ability, whereas the Kagan et al test is a measure of preference for the analytic mode. While it may be, as Chapman shows, that the social and personality characterisitcs of Maori culture (as compared to those of Pakeha culture) do not result in any significant differences in the ability to utilise an analytic mode where it is called upon by the requirements of a situation or test, it may be possible that these same characteristics will lead to a preference for a particular cognitive mode.

These studies, while not always concerning themselves with the same sets of variables, show that a number of different aspects of cognition, including cognitive style, are related to environmental factors, including both socio-economic status and ethnic group membership. However, the environmental variables used are global and descriptive, and do not of themselves explain behavioural phenomena. Hence some mechanism, or set of mechanisms, is needed to explain the correlations between aspects of cognitive competence (including stylistic preferences) and the environmental variables. Several researchers have suggested that this mechanism is to be found in the quantitative and qualitative nature of mother-child interaction patterns. For example, Shaffer & Emerson (1964) were able to discern from their research, three characteristic maternal patterns of responding to a child's demands:

1. an approach to the infant involving a great deal of physical contact;
2. an approach which relies on voice and expression for stimulation,
3. an approach whereby the mother uses directive objects, toys, or food impersonally to divert attention from herself.

While these modes of interaction had do differential effect upon attachment behaviour (in which Shaffer & Emerson were primarily interested), they felt that they may be precursors of habitual interaction patterns that affect later cognitive functioning. An attempt to explore such a contention, with specific reference to cognitive style, is reported in Hess & Shipman (1965). Using the Kagan, Moss & Sigel (1963) tests of classificatory behaviour, they found consistent relationships between socio-economic status and cognitive style, both for four year old Negro children and their mothers. Middle class mothers were higher on analytic-descriptive and categorical responses, while low status mothers were higher on relational

responses. With regard to intearction patterns, for the lower class mothers, a relational conceptual style and restricted speech pattern co-occur, and they create:

> "... a cognitive environment in which behavior is controlled by status rules rather than by attention to the individual characteristics of a specific situation and one in which behavior is not mediated by verbal cues or by teaching that relates events to one another and the present to the future. This environment produces a child who relates to authority rather than to rationale, who, although often compliant, is not reflective in his behavior, and for whom the consequences of an act are largely considered in terms of immediate punishment or reward rather than future effects and long range goals." (Hess & Shipman, 1965: 885).

The effects on the children were striking. Children from all SES groups used all categories, but there were substantial associations between high SES, and use of the analytic category, and conversely, low SES and the use of relational and non-verbal responses. The analytic response "... correlated with favorable prognostic signs for educability (such as attentiveness, control and learning ability)..." (Hess & Shipman, 1965: 880) was almost totally absent from all but the upper-middle class group.

Hess & Shipman's description of the cognitive environment provided by lower class mothers can be seen as dysfunctional to the two 'cognitive dispositions' described by Kagan et al (1963) as being fundamental to the production of analytic responses, namely: a tendency to reflect over alternative solutions that are simultaneously available; and the tendency to analyse a visual stimulus into component parts. These 'dispositions' then could be seen as providing an explanation for the dearth of analytic responses found in lower class children by both Hess & Shipman and Cohen. Also, it should be noted, these 'dispositions' have been described as 'cognitive styles' in their own right (Kogan, 1971: 244).

To summarise, the production of the qualitatively different response modes on the Kagan, Moss & Sigel Cognitive Style Test, would appear to be related to:

1. child rearing patterns (Shaffer & Emerson, 1964);
2. the nature of mother-child interactions (Hess & Shipman, 1965); and
3. the social pattern into which the child is socialised (Cohen's 'shared function' environments, 1969).

It is now necessary to turn to the New Zealand literature in order to assess whether or not any of the above factors would be relevant as a source for hypothesising about Maori-Pakeha differences in cognitive style, and which in turn may serve as explanations of Maori-Pakeha differences in achievement.

Child Rearing Practices

There is a voluminous literature on cross-cultural studies of socialisation, which has been extended to New Zealand through a series of studies under the direction of James Ritchie. In their work (Ritchie & Ritchie, 1970) a comparison is made between Maori and Pakeha patterns of child rearing. Their description of the Maori pattern of child care in early infancy places particular emphasis upon the importance of physical touch:

> "The Maori child is held and carried, goes to sleep in parental arms, is not clock fed or calendar trained. He enjoys the warmth of the lap, is passed from receptive hand to receptive hand... When the Maori child is carried, cuddled, straddled on the hip, hoisted on the back in a blanket, held in a comfortable balance in physical contact with another he is already learning to enjoy physical sensations and to trust physical responses, to relate to others in more than intellectual terms."
> (Ritchie & Ritchie, 1970: 132-33)

For Shaffer & Emerson (1964) this would appear to be a classic example of the first pattern they describe. By contrast, the Pakeha pattern described by the Ritchies, does not place the same emphasis on the importance of physical touch. Pakeha patterns would then tend to fall into the second of Shaffer and Emerson's patterns, with some falling into the third.

The different pattern of child rearing practices observed for Maori children (supported by research findings for other Polynesian groups - e.g. Hawaii, Tahiti - see Ritchie & Ritchie, 1970) would seem to be a likely contributing factor in later cognitive functioning, and of potential explanatory power in accounting for cognitive differences between Maori and Pakeha children. More so when different child rearing practices are paralleled by differences in children's play behaviour (see for example Ritchie & Ritchie, 1970: 66-68, 129-145), differences in language usage (Benton, 1964), and personality differences (Ritchie & Ritchie, 1963: part III).

The Nature of Mother-Child Interactions

There is some overlap here, whereby material in the previous section is also relevant under this heading. Ritchie in his Rakau studies emphasises the role of elder children in the socialisation of young Maori children (Ritchie, 1963: 157). Adult and parents are seen as interfering and distant reference figures in the self-contained world of the children. Control techniques tend to be authoritarian and arbitrary (Ibid). That this pattern has been transferred into urban areas is documented in Ritchie & Ritchie (1970: 143-145). If this is the case, urban-rural differences in preferred mode of cognitive style would not be as great for the Maori population as for the Pakeha group. The pattern of child rearing described for the Maoris of Rakau would appear to be similar to the kind of situation described by Hess & Shipman (1965) as dysfunctional for the production of analytic responses. If such differences between Maori and Pakeha in child rearing practices (as described by Ritchie & Ritchie) are related to differences in cognitive style, then it is to be expected that differences would be found between Maori and Pakeha children on the cognitive style test.

Social Pattern

Some parallels are to be found between what Cohen (1969) has described as a 'shared function' environment and the Ritchie's descriptions of social environmental factors in the Maori groups they studied. They report a belief "... in the rightness of unguided growth..." (Ritchie & Ritchie, 1970: 131), and the separation of the children's world from that of adults. In addition, the parent role is viewed in broader terms than is true of Pakeha groups, extending beyond the biological parents, to include uncles, aunts nd grandparents, whose homes often become like second homes to children (Ibid). Hence there are a number of "... parent-like adults" (p. 132), who give added security to the growing child. They also suggest that the competitive framework of the school puts pressure onto Polynesian children (in Hawaii as well as New Zealand) which their socialisation does not fit them to meet, as relationships to peers are all important (pp. 135-136).

In terms related to cognitive processes Ritchie states:

> "There is no tradition of objectivity - indeed such an approach is negatively sanctioned as 'cold', as unfeeling... In style, cognitive processes are rich in affective significance. (Ritchie, 1963: 150-151)

He goes on to argue that analytic problem solving was so rarely a feature of the thinking of people in Rakau that the rather formal academic approach which may be adopted in schools was certain to promote difficulties for pupils. Thus it would seem that there is a considerable amount of commonality between the child rearing environment of Maori families in New Zealand, and groups which in overseas research have a child rearing environment which is not conducive to the production of analytic responses.

The rather diverse body of literature surveyed here will now be treated as a collection of theoretical generalizations in order to derive empirical hypotheses for this study, the findings from which can then be matched against the generalizations from the literature. From a theoretical viewpoint, the literature on cognitive style surveyed in this chapter will be taken as providing justification for the basic premise that there is a relationship between certain aspects of the environments in which children are reared, and the frequency of responses in the various modes of the Kagan et al (1964) Cognitive Style Test, which such children generate. The boundary conditions for the three hypotheses to follow, are set by the parallels between the Maori pattern of socialisation (as reported by Ritchie, 1963; and Ritchie & Ritchie, 1970) and those patterns reported from groups elsewhere as being dysfunctional for the production of analytic modes of categorization (Shaffer & Emerson, 1964; Hess & Shipman, 1965; Cohen, 1969). Another boundary condition would be that Maori patterns of socialisation are different from those of the Pakeha population, as suggested in Ritchie & Ritchie (1970).

With these conditions in mind, a theoretical generalisation can be made in the following terms - the more empirical, objective and verbal are the socialisation processes and patterns in a group the greater is the likelihood that children so socialised will prefer an analytic cognitive style. From observations made of Maori socialisation patterns and processes, a more specific theoretical generalisation can be made, such that - Maori children will display a lesser preference for an analytic cognitive style than will Pakeha children, and conversely a greater preference for a relational style. From these theoretical generalisations a number of specific, derived hypotheses would seem to be logically entailed. These are as follows:

Hypothesis 1

Maori children will give more relational responses than Pakeha children

Hypothesis 2

Pakeha children will give more analytic responses than will Maori children

Hypothesis 3

Pakeha children will give more categorical responses than will Maori children

A further boundary condition can be taken from Sigel (1968: 510) who singled out rural-urban locations as offering quite different arrays of experience and available resources. Another boundary condition is set by the emphasis on the socio-economic variable in Hess & Shipman (1965) and in Cohen (1969), together with the Ritchies' suggestion that environmental variables of a socio-economic nature may be implicated, at least in part, in the patterns they describe for the Maori (1970: 129). Hence it would seem necessary to investigate the intervening effects of rural or urban residence, and socio-economic status, as follows:

Hypothesis 4

Rural children will give more relational responses than will urban children

Hypothesis 5

Urban children will give more analytic responses than will rural children

Hypothesis 6

Urban children will give more categorical responses than will rural children

Hypothesis 7

Children from low SES families will give more relational responses than will children from high SES families

Hypothesis 8

Children from high SES families will give more analytic responses than will children from low SES families

Hypothesis 9

Children from high SES families will give more categorical responses than will children from low SES families.

If, as suggested by Hess & Shipman (1965) and Shaffer & Emerson (1964), the quantity of cognitive style response is affected by the nature of parent-child interactions, then it would seem not unreasonable to suggest, as a further boundary condition, that family size, which must have some affect on the *quantity* of parent-child interactions (if not on the quality), may affect cognitive style preferences. This may be particularly relevant for Maori-Pakeha comparisons in that Maori families are on average twice the size of Pakeha ones - see Harker (1971). Also note must be taken of the warning in Ritchie & Ritchie (1970: 129) that other environmental variables (including family size) may be implicated in the child rearing practices they describe for Maori families. The following three hypotheses are included as a check on possible effects of family size on preferred cognitive mode.

Hypothesis 10

Children from large families will give more relational responses than will children from small families

Hypothesis 11

Children from small families will give more analytic responses than will children from large families

Hypothesis 12

Children from small families will give more categorical responses than will children from large families

A further boundary condition, related to patterns of socialization is the fact that sex differences in cognitive style are reported consistently in the literature (Kagan et al, 1963; Sigel et al, 1967). In a longitudinal sense, it was found that the number of categorical and analytic responses increases with age at the expense of relational responses. Both sexes show equal decreases in relational responses, while the number of analytic responses increases more rapidly for boys than for girls, and the number of categorical responses increases more rapidly for girls than for boys (Sigel et al, 1967: 3). In a cross-sectional study using Form I pupils at one New Zealand Intermediate school, Archer (1970: 137-138) found the boys gave significantly more analytic responses than girls, while girls gave significantly more relational responses than boys. For categorical responses, no significant difference was found, although the trend was in favour of boys (Archer, 1970: Table VI, p. 114).

With these findings as boundary conditions, and the basic premise that sex role expectations are largely determined by cultural factors which vary socialization experiences depending on the sex of the child, a theoretical genralization can be stated such that sex differences could be important determiners of preferred mode of cognitive categorisation. Indeed, the Kagan et al (1963) data shown in Table 1 indicates considerable discrepancies between the results for boys and those for girls. The hypotheses that suggest themselves from this are:

Hypothesis 13

Girls will give more relational responses than will boys

Hypothesis 14

Boys will give more analytic responses than will girls

Hypothesis 15

There will be no difference between boys and girls in categorical responses.

Hypotheses 1 to 15 as set out above provide basic descriptive material from which some theoretical genralizations can be evaluated. However, since the main objective is to explore ethnic differences in cognitive style preference, the possibility that findings associated with environmental variables (Hypotheses 4 - 15) may well affect the interpretations of findings associated with ethnic group membership (Hypotheses 1 - 3) must be considered.

Hence a check for interaction effects is necessary. First:

Hypothesis 16

The magnitude and direction of the effects of the environmental variables on response frequency of the different cognitive modes will be the same for both Maori and Pakeha

and second:

Hypothesis 17

The findings associated with hypotheses 1, 2 and 3 will be modified in the hypothesized directions when control is entered for the environmental variables which are themselves significantly related to cognitive style response

The hypotheses above are all dealing with frequency distributions. However, to be of use as an explanatory concept with regard to achievement, some sort of systematic relationship between achievement and responses on the Cognitive Style Test must be established. The work of Kagan, Moss & Sigel (1963: supra) and of Gray & Knief (1975: supra) will be utilised to set the expected magnitude and direction of correlations between the cognitive style modes and measures of intelligence and school achievement for the sample used in this study. Gray & Knief (1975) found negative correlations between relational responses and both intelligence and school achivement. Positive correlations between analytic responses and both intelligence and school achievement, and no correlations between categorical responses and both intelligence and school achievement. Thus:

Hypothesis 18

School achievement measures and Ravens' Progressive Matrices scores will be:

i. negatively correlated with the number of relational responses;

ii. positively correlated with the number of analytic responses; and

iii. not correlated with the number of categorical responses.

Hypothesis 19

The pattern of correlations revealed by hypothesis 18 will be the same for the Maori sub-sample as for the Pakeha sub-sample

Hypothesis 20

If differences are found in the pattern of correlations for the two ethnic groups under hypothesis 19, then a reconvergence will occur when the effects of other environmental variables (rural-urban location, age, sex, SES and family size) are partialled out.

Sample, Data Collection and Data Analysis

This section will describe the nature of the sample used in the study reported here, the data that were collected from the sample and the analyses to which the data were subjected.

The data for this study were gathered during the winter term of 1974. A total of 679 children were tested from Standard 3 classes drawn from 17 schools in the Wanganui and Wellington Education Board areas. In order to obtain data from a sufficient number of Maori pupils, and to cause a minimum of inconvenience to schools, whole classes were tested from schools having a minimum of 20% Maori enrolments. This means that a significant sector of the school population were not included in the sample - i.e. those children attending schools where Maori children form less than 20% of the enrolment. However, since the main purpose of this study was to compare Maori and Pakeha children from similar environmental circumstances, no great loss is sustained, except that the results will not be generalizable to the total

New Zealand population. An advantage is that by adopting this procedure, some matching (at a macro level) of the environments of Maori and Pakeha children in entailed.

The schools themselves range from a large school serving part of a metropolitan state housing suburb, through schools serving suburban and industrial areas in two regional centres, schools in rural towns, to small two to five teacher schools serving scattered rural areas. Some more detailed figures can be seen in Table 3.

Table 3

Roll Numbers and Pupils Tested for Schools used in Sample

School X AREA	1973 Roll	Number of Pupils Tested, 1974 Pakeha	Maori	Other	Total
Metropolitan	400	20	17	23	60
Regional Centre 1	593	86	26	3	115
Regional Centre 2, sch.1	422	46	10	6	62
sch.2	211	16	18	2	36
sch.3	196	17	15	1	33
Small Town 1	587	31	21	2	54
Small Town 2	390	21	21	-	42
Small Town 3	361	27	16	-	43
Small Town 4	305	28	13	-	41
Small Town 5	296	20	10	1	31
Small Town 6	288	21	21	3	45
Small Town 7	247	20	17	-	37
Military Camp School	196	19	7	-	26
Rural Area, School 1	196	9	11	1	21
School 2	106	10	6	-	16
School 3	98	6	4	1	11
School 4	57	2	4	-	6
TOTALS 17		399	237	32	679

The 20% Maori enrolment criterion, when applied to the metropolitan and regional centres resulted in some socio-economic bias in the sample used in this study, i.e. the schools in those centres with a 20% Maori enrolment were in areas of state rental housing largely occupied by those whose employment places them in the bottom categories of the socio-economic scale (q.v.). Hence the sample cannot be regarded as representative of the New Zealand school population (see Table 4), but it may be pointed out again that the sampling procedure provides crude matching of school and community environments, which is likely to lead to underestimates of Maori-Pakeha differences on various achievement criteria.

Table 4

Comparison of Sample Distributions with 1966 Census Figures in each of of the Elley-Irving (1972) Socio-Economic Categories (Percentages)

SES Category	Maori sub-sample (N=212)	Pakeha sub-sample (N=370)	Total sample (N=582)	1966 census distribution*
1	0.9	3.8	2.7	5.8
2	4.2	18.9	13.6	19.3
3	6.1	13.2	10.6	13.3
4	0.0	27.8	21.0	28.2
5	41.0	19.5	27.3	21.3
6	38.7	16.8	24.7	12.1
Total	99.9	100.0	99.9	100.0

* These data from Elley and Irving (1972: 163)

Information was obtained from three sources:

1. School Records: sex;
   age;
   ethnicity;
   father's occupation;
   teacher ratings from the previous year, by subject area.

2. Headmasters and Teachers: Progress Achievement Test scores;
   a check on information missing from the school record card or out of date.

3. Pupils: number of siblings;
   Ravens' Progressive Matrices raw scores;
   scores on the three dimensions of the Kagan, Moss & Sigel Cognitive Style Test.

The gathering of the data was in two phases. In phase 1, senior and post-graduate student assistants were utilized to administer the Cognitive Style Test on an individual basis to all the children in the sample. Phase 2 involved the gathering of data from school records, checking this with school staff, and administering the Ravens' Progressive Matrices Test. The complete data set was brought together and coded for computer analysis, as follows:

Name: It was necessary to keep a record of names in order to collate data obtained from different sources at different times. Subjects were assigned a three digit code number for permanent recording on IBM cards.

School: Standard 3 children at 17 schools were included in the sample. Record of the school attended was kept for each subject to facilitate later grouping into a rural-urban variable.

Sex: An important variable for control purposes due to sex differences found on the Cognitive Style Test (Kagan et al, 1963; Archer, 1970), and in school achievement studies in New Zealand (see for example Lovegrove, 1966: 26-28, 30).

Age: Date of birth was recorded from school record cards and transformed into the number of completed months at the midpoint of the testing programme (June 1st, 1974).

Ethnicity: A complex definitional problem exists with such a variable (Pools, 1963). However, since the major hypotheses of this study are derived from theories which suggest socialisation patterns as determinants of some cognitive phenomena, then any strict genetic definition of Maori as distinct from European was unnecessary. In addition, ethnicity is a controversial and sensitive area and hence could not be raised with the children themselves. Consequently, as a first approximation, this datum was taken from school records where an entry was made by the headmaster who first enrolled the child. Many of the record cards were incomplete in this respect, and in all cases (whether complete or incomplete) final recording was carried out in consultation with school staff, the major criteria being the life style of the family concerned and the extent to which the child was regarded as Maori by others. In cases where these criteria were unknown, but some Maori ancestry was known, the subject was coded as Maori. All European children (whether born in New Zealand or not) were coded as Pakeha. Other codings were for children of Chinese, Indian and Pacific Island descent, however numbers were small in these categories (see Table 3) and they have not been included in the analyses to follow. The effect of the multiple criteria for coding a subject as Maori would, if anything, underestimate Maori-Pakeha differences as some children from highly acculturated (in terms of life style) homes are included in the Maori sample.

Father's Occupation: This variable was derived from school record cards and in all cases checked with school staff to ensure accuracy and contemporaneity. The occupations were then classified according to the Elley-Irving scale (1972) to provide a six point socio-economic status index (SES) with 1 indicating the highest SES group and 6 the lowest.

Number of Siblings: At the time the Ravens' Test was administered the subjects were asked to note on their answer sheets the numbers of brothers and sisters they had. These data were used to denote family size.

Ravens' Progressive Matrices (1938): The Progressive Matrices (1938), prepared by J.C. Raven were used as a performance criterion in this study. Raven described the Matrices as:

> "... a test of a person's capacity at the time of the test to apprehend meaningless figures presented for his observation, see the relations between them, conceive the nature of the figure completing each system of relations presented, and by so doing, develop a systematic method of reasoning." (Raven, 1960: 1)

The abstract figure completion aspect of the test would seem to tap some of those areas of cognition which are also tapped by the analytic cognitive style as described by Kagan, Moss & Sigel (1963: supra). Hence the Progressive Matrices (1938) Test was used as a performance test for the children in the sample in an open ended way, ignoring the standardized time limits and using only the raw scores. I.Q. scores were not generated as there are no norms for New Zealand nine-year-olds, and the age range of children in this study is not great. This test then, was used as a measure of analytic reasoning ability of a non-verbal nature (irrespectively of how quickly the subject reasoned) to be used as an achievement criterion along with Progressive Achievement Test scores and Teacher Ratings.

Cognitive Style Test: This is a 25 item test developed from the children's version of the Conceptual Style Test reported in Kagan, Moss & Sigel (1963) - see Appendix 1, where the test is reproduced, together with the instructions used. Archer (1970) used this test on New Zealand school children, and found that some items produced only one particular response mode from all children in his sample and were thus deleted from his analysis. The 25 items used in the study reported here are the ones Archer left in his analysis in order to facilitate direct comparison with the results he found for the older age group in his study.

Progressive Achievement Tests (PAT): Three of these tests, developed by the New Zealand Council for Educational Research for use in New Zealand schools, were currently in use at the time of data collection. They are given to all children early in each year by school staff. The results, for the children in this study, of the Reading Comprehension Test, Reading Vocabulary Test and the Listening Comprehension Test were collected from school records. During subsequent analysis, the raw scores for the three tests were added together to produce a composite PAT index, for use as a criterion measure of school achievement.

Teacher Ratings: At the end of each year, teachers are required to rate children on a five point scale in a number of subject areas, for inclusion on school record cards. At the Standard 3 level, only the first six subject areas are required to be considered, although some teachers rate the other subject areas as well. The five point scale is as follows:

1. excellent;
2. above average;
3. average;
4. below average; and
5. unsatisfactory.

As with the PAT scores, a composite Teacher Rating index was used in analysis, devised by adding together the ratings given by teachers in the previous year for the six major subject areas - oral language, written language, reading, spelling, writing, and arithmetic. This index was also used as a criterion measure of school achievement, although it should be noted that the index has a negative direction, i.e. the lower the index score, the higher the achievement level.

These data items were coded and conveyed on to IBM computer cards. The analysis of the data was undertaken using SPSS routines (Statistical Package for the Social Sciences) on the Burroughs B6700 installation at Massey University. SPSS is a statistical package in which a data deck is described and labelled, and in which specific statistical routines are available to be called in for use with the data deck. A full description of this facility is to be found in Massey University Computer Unit (no date) and in Nie et al (1975). Specific statistical procedures used in this study were as follows:

CODEBOOK: for basic frequency distributions and descriptive statistics where appropriate. This routine was used for the sample as a whole and separately for Maori and Pakeha sub-samples.

CROSSTABS: produces contingency tables for nominal or ordinal data, together with appropriate statistics such as chi-square.

BREAKDOWN: this routine was used to break down scores on interval data variables by selected nominal or ordinal categories such as ethnicity or SES. It produces means and standard deviations of the continuous variable for each of the nominal or ordinal categories.

T-TEST: to test the significance of differences found with BREAKDOWN.

NONPAR-CORR: non-parametric correlation coefficent for the relationships between cognitive style and school achievement measures.

Findings

In this section the hypotheses derived from the literature surveyed above will be tested against the data collected for this study, and the theoretical significance of the findings considered.

In the light of the overseas findings on cognitive style and cultural differences, it seems reasonable to propose that cognitive style could also be an important variable in reducing the direct effect of ethnicity on achievement scores. Hypotheses 1, 2 and 3 have two purposes: first, to test the theoretical generalization that cognitive style is a function of cultural difference; and, second to see whether or not it is worthwhile to include cognitive style as an independent variable in a multi-variate expianation of Maori-Pakeha achievement differences.

The relevant hypotheses are:

Hypothesis 1

Maori children will give more relational responses than will Pakeha children

Hypothesis 2

Pakeha children will give more analytic responses than will Maori children

Hypothesis 3

Pakeha children will give more categorical responses than will Maori children.

The data presented in Table 5 do not sustain any of the three hypotheses. The small differences that are observable in the data are in the hypothesised direction, but are quite insuffucient to reject the null alternative. Thus the theoretical generalisation that cognitive style is a function of cultural difference is not sustained by this study of nine-year-old Maori and Pakeha children. Furthermore, the degree of similarity of the response frequencies on the cognitive style test within both groups being studied, indicates that stylistic preference would have little or no effect in a multi-variate explanation of Maori-Pakeha achievement differences.

Table 5

Number of Relational, Analytic and Categorical Responses on the Cognitive Style Test, by Ethnic Group (one-tailed criterion)

	Pakeha (N=368)		Maori (N=207)		
	Mean	S.D.	Mean	S.D.	t
Number of relation response.	11.793	5.686	12.130	5.486	0.69
Number of analytic responses	5.427	3.922	5.314	4.102	0.33
Number of analytic responses	7.769	4.223	7.498	3.540	0.82(+)

(+) Separate variance estimate, otherwise the pooled variance estimate used.

A further theoretical generalization derived from the literature was that cognitive style is a function of environmental variables which have an effect on life style, such as rural or urban residence, SES and family size. The effects of each of these environmental variables on response frequency for the Cognitive Style Test will be examined in turn. The hypotheses for rural/urban location were as follows:

Hypothesis 4

Rural children will give more relational responses than will urban children

Hypothesis 5

Urban children will give more analytic responses than will rural children

Hypothesis 6

Urban children will give more categorical responses than will rural children

All three of the hypotheses relating to rural/urban location differences with the frequency of responses on each cognitive mode, are supported by the data presented in Table 6. Hence the null alternative of no difference can be confidently rejected in each case. Rural/urban differences are most strongly reflected in the number of relational responses, followed by analytic responses, with categorical responses least differentiated, though still at a statistically significant level.

Table 6

Number of Relational, Analytic and Categorical Responses on the Cognitive Style Test, by Location (one-tailed criterion)

	Urban (N=245)		Rural (N=330)		
	Mean	S.D.	Mean	S.D.	t
Number of relational responses	11.029	5.612	12.573	5.530	3.29**
Number of analytic responses	5.943	4.186	4.973	3.782	2.91**
Number of categorical responses	8.004	4.135	7.424	3.867	1.73*

Pooled variance estimates used.

* $p < 0.05$
** $p < 0.01$

The hypotheses for SES and its effects on cognitive style were:

Hypothesis 7

Children from low SES families will give more relational responses than will children from high SES families

Hypothesis 8

Children from high SES families will give more analytic responses than will children from low SES families

Hypothesis 9

Children from high SES families will give more categorical responses than will children from low SES families

The data in Table 7 do not lend support to any of the SES hypotheses. The number of categorical responses shows the greatest reaction to SES differences, and the number of analytic responses is in a direction opposite to that hypothesised. However, the reported differences are insufficient to reject the null alternative, and lend no support to the generalization that SES affects cognitive style.

Table 7

Number of Relational, Analytic and Categorical Responses on the Cognitive Style Test, by Socio-Economic Status (SES), (one tailed criterion)

	High SES groups 1 - 4* (N=253)		Low SES groups 5 - 6 (N=272)		
	Mean	S.D.	Mean	S.D.	t
Number of relational responses	11.779	5.919	12.088	5.426	0.63
Number of analytic responses	5.257	4.026	5.484	4.082	< 0
Number of categorical responses	7.956	4.375	7.390	3.710	1.60(+)

(+) separate variance estimate, otherwise the pooled variance estimate used.

* groupings made from the Elley and Irving (1972) scale.

The hypotheses for family size differences, and their effects on cognitive style were:

Hypothesis 10

Children from large families will give more relational responses than will children from small families

Hypothesis 11

Children from small families will give more analytic responses than will children from large families

Hypothesis 12

Children from small families will give more categorical responses than will children from large families

The data in Table 8 do not lend support to any of the three hypotheses, although, as for SES, the categorical responses are more pronounced than for the other two modes of response. Again, as for SES, the number of analytic responses show a slight tendency in the direction opposite to that hypothesised. However, it can be concluded that the data in this study do not support the generalization that family size affects cognitive style responses.

Table 8

Number of Relational, Analytic and Categorical Responses on the Cognitive Style Test, by Family Size, (one tailed criterion)

	Less than 4 siblings (N=320)		4 or more siblings (N=215)		
	Mean	S.D.	Mean	S.D.	t
Number of relational responses	11.737	5.527	12.061	5.671	0.66
Number of analytic responses	5.281	3.817	5.516	4.131	< 0
Number of categorical responses	7.950	4.152	7.386	3.728	1.60

Pooled variance estimates used.

Of the three environmental variables tested in this study, only rural/urban location covaries with cognitive style response frequencies. Neither SES nor family size covary in this way, thus necessitating a revision of the original theoretical generalisation (cognitive style is a function of environmental variables), to a much more modest statement such that cognitive style covaries with one environmental variable (rural/urban location) but not with others (SES and family size). More empirical generalisations of this type would need to be established before the theoretical generalisation could be comprehensively evaluated, and also a great deal of further work is called for to establish whether covariation between a variable such as rural/urban location and cognitive style necessarily implies a functional (causal) relationship.

A third theoretical generalisation noted above was that cognitive style would be a function of sex role socialisation. The hypotheses derived from this generalisation were:

Hypothesis 13

Girls will give more relational responses than will boys.

Hypothesis 14

Boys will give more analytic responses than will girls

Hypothesis 15

There will be no difference between boys and girls in number of categorical responses

Table 9 shows insufficient difference in the number of relational responses to enable a rejection of the alternative hypothesis of no difference. The number of categorical responses show no significant difference, thus supporting Hypothesis 15. For the analytic mode however, a difference in favour of boys is of sufficient magnitude to confidently support Hypothesis 14. This finding is in agreement with that of Archer (1970: 114) who, in addition, found a significant difference in favour of girls on the number of relational responses. A slight trend in this direction is noticeable in Table 9, but nothing like the

Table 9

Number of Relational, Categorical and Analytic Responses on the Cognitive Style Test, by Sex Group, (one-tailed criterion)

	Male (N=269)		Female (N=304)		
	Mean	S.D.	Mean	S.D.	t
Number of relational responses	11.729	5.672	12.128	5.544	0.85
Number of analytic responses	5.838	4.191	4.967	3.741	2.61**
Number of categorical responses (++)	7.446	3.834	7.845	4.119	1.20

Pooled variance estimates used ** $p < 0.01$

(++) two-tailed criterion for categorical responses

strong trend shown in Archer's data. It must be remembered however, that Archer's sample compared Form I pupils who were two years ahead of the children used in the present study. Sigel et al (1967: 3) may be relevant here. They indicate that the number of relational responses decreases with age for both sexes. Comparison of Table 9 with Archer's Table VI indicates that in the New Zealand context the decrease is much more rapid for boys than for girls, although it must be remembered that the samples involved were drawn from different areas and on different bases. However, the trend in the number of analytic responses between the data in Table 9 and that presented by Archer are in close agreement with the findings of Sigel et al (1967), which suggests that the departure of the New Zealand data from the American norms with regard to the relational responses may be of some consequence.

The hypothesis to be considered next was formulated to test whether the same pattern of findings occurs within each ethnic group used in this study.

Hypothesis 16

The magnitude and direction of the effects of the environmental variables on response frequency of the different cognitive modes will be the same for both Maori and Pakeha

Inspection of the within groups t-statistics presented in Table 10 shows that the two variables which showed significant associations with cognitive style responses for the whole sample (rural/urban for all three cognitive modes and sex for analytic mode), confine their significant association entirely to the Pakeha group when a within group analysis is made. The equivalent groups in the Maori sub-sample show similar trends (close to statistical significance in three of the four cases) but of lesser relative magnitude. Cognitive style is little affected by environmental variables when looked at within the Maori sub-sample. In addition, the environmental variables which had no effect on cognitive style responses for the sample as a whole, are equally ineffective within each ethnic group, thus Hypothesis 16 can be rejected against the alternative for those environmental variables which have significant overall effects.

Table 10

Within and Between Group Differences in Number of Relational, Analytic and Categorical Responses on The Cognitive Style Test, by Location, Family Size, SES and Ethnicity (one tailed criterion)

Variable	Pakeha N	Pakeha Mean	Pakeha S.D.	Maori N	Maori Mean	Maori S.D.	Between group t
Relational Responses							
Urban	167	12.868	5.512	78	11.372	5.842	0.65
Rural	201	12.562	5.728	129	12.589	5.229	0.04
Within group t		2.869**			1.551		
Small family	254	11.673	5.657	66	11.985	5.031	0.41
Large family	93	11.742	5.722	122	12.303	5.644	0.72
Within group t		0.100			0.382		
High SES	215	11.800	5.948	38	11.658	5.832	<0
Low SES	126	12.048	5.335	146	12.123	5.522	0.11
Within group t		0.386			0.457		
Male	172	11.599	5.775	97	11.959	5.506	0.50
Female	196	11.964	5.616	108	12.426	5.424	0.69
Within group t		0.614			0.611		
Analytic Responses							
Urban	167	5.946	3.918	78	5.936	4.735	0.02(+)
Rural	201	4.995	3.881	129	4.938	3.635	0.13
Within group t		2.327**			1.599(+)		
Small family	254	5.287	3.791	66	5.258	3.947	0.05
Large family	93	6.000	4.399	122	5.148	3.893	1.50
Within group t		1.386(+)			<0		
High SES	215	5.265	4.001	38	5.211	4.218	0.08
Low SES	126	5.556	3.935	146	5.425	4.218	0.26
Within group t		0.652			0.279		
Male	172	5.878	4.193	97	5.753	4.208	0.23
Female	196	5.031	3.632	108	4.852	3.945	0.40
Within group t		2.057(+).			1.581		

cont.

Table 10 (cont.)

Categorical Responses							
Urban	167	8.192	4.298	78	7.603	3.757	1.04
Rural	201	7.418	4.138	129	7.434	3.416	<0(+)
Within group t		1.795*			0.332		
Small family	254	8.016	4.340	66	7.697	3.347	0.65(+)
Large family	93	7.258	3.856	122	7.484	3.641	<0
Within group t		1.483			0.393		
High SES	215	7.926	4.394	38	8.132	4.319	0.27
Low SES	126	7.397	4.066	146	7.384	3.388	0.03(+)
Within group t		1.102			0.991(+)		
Male	172	7.547	4.059	97	7.268	3.411	0.60(+)
Female	196	7.964	4.363	108	7.630	3.644	0.71(+)
Within group t		0.946			0.731		

(+) Separate variance estimate, otherwise pooled variance estimate.
* $p < 0.05$
** $p < 0.01$

Similarly it could be argued that controlling for the environmental variables may substantially affect the magnitude of the ethnic differences on the cognitive style test - (which were in fact non-significant, see Table 5).

Hypothesis 17

The findings associated with Hypotheses 1, 2 and 3 (see Table 5) will be modified in the hypothesised directions when control is entered for the environmental variables which are themselves significantly related to cognitive style response

Inspection of the between groups t-tests in Table 10 shows that controlling separately for the environmental variables (as main effects),produces no significant ethnic difference on any of the cognitive modes. However, the possibility of interaction effects between the environmental variables (together with ethnicity) and their effects on cognitive style must not be discounted. In order to check this possibility, the data have been reanalysed, controlling for each environmental variable in turn, as set out in Table 11, parts (i), (ii) and (iii). SES has not been included in this analysis as it makes the least contribution to explaining between group variance on the cognitive style test (see Table 10) and to include it in Table 11 would reduce cell sizes to unworkable levels.

Table 11 attempts to identify within the sample being studied, the precise location of any ethnic difference in cognitive style response modes, and for which of the ethnic groups these locations are most significant. Overall, the three parts of Table 11 are almost

Table 11 (i)

Number of Relational Responses on the Cognitive Style Test, by Location, Family Size, Sex and Ethnic Group (1-tailed criterion)

Loc.	No. of siblings	Sex	N	Pakeha Mean	S.D.	N	Maori Mean	S.D.	Between group t
Urban	≤ 3	Male	50	10.300	5.482	11	12.000	5.235	0.938
		Female	62	11.210	5.806	11	9.636	5.697	< 0
		Within group t		0.845			0		
	> 3	Male	17	10.647	5.384	24	10.625	5.962	< 0
		Female	27	9.519	4.154	27	12.259	6.199	1.908 (+)*
		Within group t		< 0			< 0.957		
Rural	≤ 3	Male	68	11.897	5.718	18	11.944	4.952	0.032
		Female	74	12.784	5.458	26	13.000	4.656	0.180
		Within group t		0.946			0.721		
	> 3	Male	26	13.000	6.536	36	12.861	5.642	< 0
		Female	23	13.739	5.817	34	13.235	4.632	< 0
		Within group t		0.416			0.302		

(+) Separate variance estimate, otherwise pooled variance estimate. * $p < 0.05$

precisely evenly divided with 11 of the 24 between group comparisons in favour of the Maori group and 13 in favour of the Pakeha group. However, four of the comparisons show a statistically significant difference. For relational responses (part (i) of Table 11) females from large families living in urban areas show a trend in favour of Maori pupils. Conversely, this same group show a significant trend in favour of Pakeha pupils on the number of analytic responses. Closer inspection of the data indicates that it is the Pakeha girls concerned who are the exceptional group. They are quite noticeably polarized between relational and analytic responses, having the lowest relational score of any group (9.519, Table 11 (i)), and the highest analytic score (7.407, Table 11 (ii)). This extreme response set of the Pakeha group concerned accounts for two of the four significant ethnic differences, as the scores of the equivalent Maori group do not show this extreme reaction and are not noticeably different from the other Maori sub-groups. Two other significant ethnic differences are to be found. Analytic responses favour Pakeha males from large families in rural areas (Table 11 (ii)), and categorical responses for males from small urban families (Table 11 (iii)). Neither of these two differences would stand up to the two-tailed criterion, and on balance, with only four significant differences out of 24 comparisons and with the remaining non-significant differences being equivocal with regard to directionality, it would be unwarranted to modify the findings reported for Hypotheses 1, 2 and 3 which suggest no systematic relationship between ethnicity and preferred mode of cognitive style.

Hypotheses 1 to 17 have been concerned with exploring and elaborating a theoretical relationship between environmental variations (together with ethnicity) and cognitive style.

Table 11 (ii)

Number of Analytic Responses by Location, Family Size, Sex and Ethnic Group (1-tailed criterion)

Loc.	No. of siblings	Sex	N	Pakeha Mean	S.D.	N	Maori Mean	S.D.	Between group t
Urban	≤ 3	Male	50	6.100	3.950	11	6.636	5.372	< 0
		Female	62	5.258	3.585	11	5.000	4.025	0.216
		Within group t		1.181			0.808		
	> 3	Male	17	6.882	4.999	24	7.333	5.113	< 0
		Female	27	7.407	3.885	27	4.852	4.435	2.252*
		Within group t		< 0			1.856*		
Rural	≤ 3	Male	68	5.794	4.098	18	5.111	2.541	0.878(+)
		Female	74	4.297	3.391	26	4.885	4.131	< 0
		Within group t		2.379**			0.224(+)		
	> 3	Male	26	5.462	4.950	36	4.694	3.060	1.720(+)*
		Female	23	4.304	3.267	34	4.088	2.261	0.295
		Within group t		0.953			0.938		

(+) Separate variance estimate used, otherwise pooled variance estimate.
* $p < 0.05$
** $p < 0.01$

No consideration has been given to achievement and its role as a criterion variable. It is possible that despite no relationship between ethnicity and cognitive style, the relationship between cognitive style and achievement may vary within each of the ethnic groups used in this study. Hypotheses 18 and 19 were formulated to test this possibility, using the findings of the Gray & Knief study (1975, supra) as empirical generalisations to set the directionality of Hypothesis 18.

Hypothesis 18

School achievement measures and Ravens Progressive Matrices scores will be:

(i) negatively correlated with the number of relational responses;

(ii) positively correlated with the number of analytic responses; and

(iii) not correlated with the number of categorical responses.

Table 12 shows that for all the sub-scales of the Teacher Rating Index (together with those subject areas rated by teachers but not included in the Index), for the sub-scales of the PAT Index and for Ravens' raw scores, the correlations with the three cognitive modes are in accord with Hypothesis 18. While the correlations are not large they are consistent and show a tendency to polarize on a relational-analytic dimension, with categorical responses falling between the two extremes. The findings are generally in line with those of Gray & Knief as outlined earlier, for fifth grade American children. Hypothesis 19 was formulated

Table 11 (iii)

Number of Categorical Responses, by Location, Family Size, Sex and Ethnic Group (1-tailed criterion)

Loc.	No. of siblings	Sex	N	Pakeha Mean	S.D.	N	Maori Mean	S.D.	Between group t
Urban	≤ 3	Male	50	8.600	3.912	11	6.364	3.295	1.759*
		Female	62	8.500	4.821	11	10.273	3.438	< 0
		Within group t (++)		-0.118			2.722**		
	> 3	Male	17	7.471	4.079	24	7.000	2.554	0.421 (+)
		Female	27	8.074	3.615	27	7.704	4.539	0.331
		Within group t		0.513			0.692 (+)		
Rural	≤ 3	Male	68	7.324	4.116	18	7.944	3.334	< 0
		Female	74	7.851	4.375	26	7.000	2.871	1.222 (+)
		Within group t		0.738			-1.004		
	> 3	Male	26	6.538	4.042	36	7.417	4.003	< 0
		Female	23	6.957	3.808	34	7.647	3.228	< 0
		Within group t		0.372			0.264		

(+) Separate variance estimate, otherwise pooled variance estimate.
(++) 2-tailed criterion for within group t's on Sex - see Hypothesis 15.
* $p < 0.05$
** $p < 0.01$

to test the stability of the findings for Hypothesis 18 within each ethnic sub-sample.

Hypothesis 19

The pattern of correlations revealed by Hypothesis 18 will be the same for the Maori sub-sample as for the Pakeha sub-sample.

Table 13 contains the same data items as Table 12 broken down for each ethnic group separately. Inspection of Table 13 shows that the pattern of correlations found for the whole sample is maintained in the sub-sample analysis only for the Pakeha group. The Maori group shows no such consistency, with the correlations fluctuating around zero. Hence rejection of Hypothesis 19 seems reasonable, but must be regarded with some caution due to the rather weak associations inherent in the small correlations, as against the consistency of the directionality for the Pakeha sub-sample and the indeterminancy of the Maori sub-sample.

As with previous findings in this section, the possibility exists that the differences between Maori and Pakeha with respect to the correlations between cognitive style and achievement may be due to the intervention of other environmental variables for which the groups are not matched. Hence Hypothesis 20 seeks to replicate the findings from the test of Hypothesis 19 after statistically controlling for the effects of other environmental variables through partial correlation.

Table 12

Correlations of Achievement Criteria by Responses on the Cognitive Style Test - Kendall's T for Subjects Rated by Teachers, Spearman's r for PAT and Ravens' Scores (one-tailed criterion for Relational and Analytic Responses, two-tailed for Categorical)[1]

Criterion	N	Relational responses	Categorical responses	Analytic responses
Subjects Rated by Teachers				
Oral language	560	-0.04	-0.01	0.05*
Written language	561	-0.03	0.02	0.03
Reading	561	-0.06*	0.06*	0.05*
Spelling	560	-0.04	0.05	0.03
Writing	561	-0.02	0.00	0.01
Arithmetic	561	-0.04	0.01	0.07**
Social studies	254	-0.06	0.05	0.09*
Nature Study	249	-0.03	0.04	0.01
Art and Craft	219	-0.09*	0.02	0.15**
Music	211	-0.08*	0.07	0.04
P.Ed.	212	-0.01	0.05	0.07
PAT Raw Scores				
Reading Comprehension	474	-0.06	0.07	0.02
Reading Vocabulary	487	-0.08*	0.08	0.08*
Listening Comprehension	471	-0.08*	0.04	0.09*
Raven's Raw Scores				
	534	-0.07*	0.03	0.11**

* p less than 0.05

** p less than 0.01

(1) Significance computed using: $z = \frac{T}{\sqrt{\frac{2(2N + 5)}{9N(N-1)}}}$ for Kendall's T;

and $t = r_s \sqrt{\frac{N - 2}{1 - r_s^2}}$ for Spearman's r (Siegel 1956: 221 and 212).

Table 13

Correlations of Achievement Criteria by Responses on the Cognitive Style Test, by Ethnic Group - Kendall's T for Teacher Ratings, Spearman's r for others (one-tailed for Relational and Analytic, two-tailed for Categorical)[1]

Criterion	N P	N M	Relational P	Relational M	Categorical P	Categorical M	Analytic P	Analytic M
Subjects Rated by Teachers								
Oral language	360	200	-0.04	-0.01	0.00	-0.02	0.07*	0.01
Written lang.	361	200	-0.09**	0.08*	0.05	-0.05	0.08*	-0.06
Reading	361	200	-0.07*	0.00	0.07*	0.03	0.06	-0.01
Spelling	361	199	-0.07*	0.02	0.05	0.04	0.07*	-0.04
Writing	361	200	-0.04	0.02	0.02	-0.02	0.02	-0.03
Arithmetic	361	200	-0.10**	0.07	0.06	-0.07	0.11**	-0.01
Social studies	163	91	-0.08	0.02	0.07	0.02	0.14**	-0.03
Nature study	162	87	-0.02	0.00	0.05	0.01	0.04	-0.07
Art and Craft	137	82	-0.10*	-0.08	0.08	-0.08	0.13*	0.19**
Music	135	76	-0.06	-0.13	0.10	0.02	0.03	0.07
Phys. Ed.	134	78	0.04	-0.09	0.06	-0.03	0.06	0.09
PAT Raw Scores								
Reading Comprehension	329	145	-0.09	0.00	0.10	0.01	0.05	-0.03
Reading Vocabulary	332	155	-0.15**	0.05	0.12*	0.01	0.15**	-0.02
Listening Comprehension	325	146	-0.14**	-0.01	0.09	-0.05	0.11*	0.06
Raven's Raw Scores								
	347	188	-0.10*	0.02	0.06	-0.05	0.11*	0.08

* $p < 0.05$
** $p < 0.01$

1. See note 1. of Table 12.

Hypothesis 20

If differences are found in the pattern of correlations for the two ethnic groups under Hypothesis 19, then a reconvergence will occur when the effects of other environmental variables (age, sex, SES, family size and rural/urban) are partialled out.

To reduce the mass of data to more manageable dimensions, Table 14 reports the partial correlation data for the Teacher Rating Index, rather than separate analyses for each individual subject rated by the teachers. Similarly, Table 15 reports data for the PAT Index.

Table 14

Correlations and Partial Correlations Between the Composite Teacher Rating Index and Scores on the Cognitive Style Test, by Ethnic Group (one-tailed criterion)

Correlations	Relational		Categorical		Analytic	
	P[1]	M	P	M	P	M
Zero order r	-0.16**(+)	0.07	0.10	-0.04	0.12*	-0.06
First order partial for age	-.013*	0.10	0.07	-0.05	0.11*	-0.08
First order partial for sex	-.19**	0.07	0.10	-0.08	0.16**	-0.03
First order partial for SES	-.16**	0.08	0.08	-0.06	0.13*	-0.07
First order partial for family size	-.15**	0.07	0.09	-0.04	0.12*	-0.06
First order partial for rural-urban	-0.17**	0.07	0.10	-0.04	0.12*	-0.06
Fifth order partial for all above	-0.17**(+)	0.11	0.06	-0.11	0.17**	-0.05

1. P: N=272 M: N=107

* $p < 0.05$ ** $p < 0.01$

(+) Maori and Pakeha correlations are significantly different from each other. (Ferguson, 1971: 187-188)

Table 15

Correlations and Partial Correlations Between Composite Pat Index and Scores on the Cognitive Style Test, by Ethnic Group (one-tailed criterion)

Correlations	Relational		Categorical		Analytic	
	P	M	P	M	P	M
Zero order r	-0.12*	0.03	0.08	0.02	0.09	-0.04
First order partial for age	-0.10	0.05	0.06	0.01	0.07	-0.06
First order partial for sex	-0.13*	0.03	0.08	-0.001	0.10*	-0.02
First order partial for SES	-0.12*	0.05	0.07	-0.01	0.096	-0.05
First order partial for family size	-0.11*	0.03	0.07	0.02	0.09	-0.04
First order partial for rural-urban	-0.15**	0.01	0.10	0.02	0.11*	-0.03
Fifth order partial for all above	-0.14*	0.04	0.06	-0.03	0.12*	-0.02

* $p < 0.05$ ** $p < 0.01$

Table 16

Correlations and Partial Correlations Between Ravens' Raw Scores and Cognitive Style Test Scores, by Ethnic Group (one-tailed criterion)

Correlations	Relational		Categorical		Analytic	
	P	M	P	M	P	M
Zero order r	-0.09*	0.03	0.03	-0.06	0.11*	0.02
First order partial for age	-0.09	0.05	0.02	-0.07	0.11*	0.00
First order partial for sex	-0.10*	0.03	0.02	-0.06	0.12*	0.02
First order partial for family size	-0.09	0.03	0.01	-0.06	0.12*	0.02
First order partial for SES	-0.09*	0.03	0.02	-0.06	0.12*	0.02
First order partial for rural-urban	-0.10*	0.04	0.03	-0.06	0.11*	0.01
Fifth order partial for all above	-0.09	0.05	0.01	-0.07	0.13**	-0.00

* $p < 0.05$
** $p < 0.01$

Pakeha, N=321
Maori, N=166

From Table 14 it can be seen that controlling for environmental variables through partialling has no effect on the differences between the Maori and Pakeha sub-sample correlations between the Teacher Rating achievement criterion and cognitive style scores. Certainly no reconvergence takes place as the correlation coefficients are just as far apart after partialling as they were before - in fact slightly further apart. A similar trend is observable in Table 15 for the PAT Index where, again, partialling does not bring about any convergence of the correlation coefficients, and in Table 16 for Ravens' scores. For all three achievement criteria Hypothesis 20 is rejected as no convergence of the correlation coefficients occurs as a result of partialling. It should be noted that only for the Teacher Rating Index's correlation with the relational cognitive mode does the correlation coefficients for Maori and Pakeha differ at a statistically significant level, although the same Index with the analytical mode comes very close to producing a statistically significant difference as well (a z of 1.925 for a difference as large as that reported, 0.17 for Pakeha and -0.05 for Maori). The other two achievement criteria confirm the trends shown for the Teacher Rating Index but at a slightly lower level of intensity. Rejection of Hypothesis 20 indicates that the weak but consistent differences in the relationship between cognitive style and achievement that show up when Maori and Pakeha subjects are analysed separately are due to differences associated with the ethnic variable rather than to any of the environmental variables used in this analysis. This is not to say of course that the difference is necessarily of racial or cultural origin, as the addition of other environmental variables not considered for this study could well account for the differences found. On the other hand, the difference may be of racial or cultural origin, the point being that no location can be pin-pointed as a source for the small observed differences from the data in this study. All that can be said is that the most frequently cited environmental variables do not account for the ethnic differences observable in Table 13.

Summary and Discussion of Findings in Relation to Other Research

The main objectives of this section have been to explore the ethnic group differences in cognitive style response modes, and their relationship to achievement. The most striking aspect of the data reported here is the lack of any significant relationship between response

frequency on the Cognitive Style Test and either ethnicity or the environmental variables SES and family size - see Tables 5, 7 and 8. These findings are generally contrary to the patterns outlined in the overseas research. The disagreement between the work of Cohen (1969) and the Lesser group (Lesser, Fifer & Clark (1965); Stodolsky & Lesser (1967); Marjoribanks (1972)) as to whether SES or Ethnicity is the prime determiner of cognitive acquisitions is of no moment for the data presented here. It appears that for these New Zealand children neither ethnic differences nor SES differences in child rearing patterns, nor the actual size of the family of origin has any effect on preferred mode of cognitive style. The failure of the Cognitive Style Test as a differentiator between Maori and Pakeha subjects is in agreement with the New Zealand findings of Chapman (1973) who found no difference between Maori and Pakeha adolescent males on another dimension of cognitive style, the Witkin field dependence-independence dimension. Further, the discrepancies between the relationships of cognitive style and achievement in the Maori sub-sample as compared to the Pakeha sub-samples (Table 13) could be interpreted as lending support to Chapman's contention that the Maori

> "... may be as analytic in thought and perception as the Pakeha, but his thought is directed more toward interpersonal rather than occupational or academic goals."
> (Chapman, op.cit.: 43)

Certainly the data in Table 5 indicate that the Maori pupils *are* as capable of producing analytic responses in a test situation as are Pakeha pupils. Furthermore, while being unable to show that Maori thought is directed toward 'interpersonal goals', the data in Tables 13, 14, 15 and 16 show at least that cognitive style and achievement (academic goals in Chapman's terminology) are independent phenomena for the Maori group but weakly interrelated for Pakehas, which suggests that some cognitive phenomena are utilised for different purposes by children in the two ethnic groups.

The failure of the cognitive style measure as a discriminator between SES categories brings into question the applicability to New Zealand of the findings of Cohen (1968, 1969) discussed above. This is not to invalidate Cohen's findings, but to suggest that the life style differences between low and middle income groups in the United States are greater than in New Zealand where income differentials are not as great to start with. Thus her claim that the social pattern into which the child is socialised is a major determinant of cognitive style may still be perfectly valid, and the fact that it does not emerge from the data in this study may simply be a consequence of New Zealand's much flatter social topography. If, as Hess & Shipman (1965) claim, preferred mode of cognitive style is due to qualitative differences in the nature of mother-child interactions, or to general child rearing patterns (Shaffer & Emerson, 1964), then from the present sample it would appear that child rearing patterns and the quality of mother-child interactions do not differ between SES groups, or between Maori and Pakeha families in ways that significantly affect preferred mode of cognitive style. This does not mean that they do not differ, but that any differences are not reflected in responses to the Kagan et al (1963) Cognitive Style Test.

Much of the literature on Maori education in New Zealand has concentrated on the differences between Maori and Pakeha, not only in terms of school achievement, but also focussing on the large size of Maori families, their overrepresentation in the low occupational categories and their different patterns of child rearing (Ritchie & Ritchie, 1970). The data presented here suggest that at least for one aspect of cognition, stylistic preference, these kinds of differences are of no moment. In addition the data suggest that some attention should perhaps be devoted to similarities between groups as these would seem to far outweigh the differences.

The only environmental variable to have a significant impact on all three cognitive modes was rural/urban location (Table 6). This finding lends support to Sigel's contention

(1968: 510) noted above, that the different arrays of experience offered by rural and urban areas affect the content and range of experience to which children are exposed, and also the preferred mode by which children organize stimuli of the type presented in the Kagan, Moss & Sigel Cognitive Style Test. However, when the rural/urban location dichotomy is examined for its effect on cognitive style response frequencies *within* each of the ethnic groups under study (see Tables 10 and 17), it can be seen that the statistically significant rural/urban variance is located within the Pakeha group. A similar trend is observable for relational and analytic responses within the Maori group, and although it does not reach a statistically significant level, it should not, on that account, be regarded as non-existant. The other variable which accounted for some of the variation in cognitive style responses was sex, particularly for the analytic mode (Table 9). If sex is introduced into the rural/urban analysis, some more detailed conclusions can be drawn. In Table 17, rural/urban differences are analysed for each cognitive mode by ethnicity, then by sex and then by sex within ethnicity. This table shows that for relational responses rural or urban location is of no consequence for the Maori pupils, whether boy or girl, as all of the significant differences are confined to the Pakeha group. For analytic responses the effects of ethnicity and of sex are similar to the relational pattern, but a disordinal interaction appears when the effect of sex is examined within ethnicity. Rural or urban location strongly affects the number of analytic responses for Maori boys (but not Maori girls), while for Pakeha the significant effect is for girls and not boys. For categorical responses rural/urban location has a significant effect only for Pakeha groups. In general, from the Table it would appear that rural environments tend to favour the production of relational responses while urban environments favour both analytic and categorical responses, with the exception of Maori boys for whom an urban environment is particularly conducive to the production of analytic responses at the expense of categorical ones thus producing an anamalous trend for this group on categorical responses.

The data presented in this section would tend to support McDonald's warnings (1975: 75-93) about the blanket application of essentially European notions of differentiation such as rural/urban, socio-economic status and so on. These data would suggest that the effect of rural or urban residence has a different influence on Maori children than on Pakeha children in terms of their predisposition to respond in the various modes of the Cognitive Style Test. Similarly, the reasons for sex differences that are advanced in other literature cannot be applied to the Maori children in this study, as in some cases the direction of the differences are in opposite directions to those found for the Pakeha children. There would appear to be ground for suggesting that the socialisation of sex roles, at least those aspects of sex role that result in different cognitive stylistic preferences, are qualitatively different in Maori society from that found in Pakeha society.

To return to a theoretical point made at the beginning of this chapter, the findings presented here would not seem to offer much hope that cognitive style could act as an intervening variable to further reduce the direct effect of ethnicity on achievement, over and above the reduction shown elsewhere, to occur when environmental variables are statistically controlled (Harker, 1976: Chapter 4).

A final point concerns the relationships between the various modes of the Cognitive Style Test itself, where a considerable difference exists between the New Zealand data reported here and the findings of the Gray & Knief (1975) study described earlier. Gray & Knief found no correlation between the categorical and relational modes, and significant correlations between categorical and descriptive (analytic) modes on the one hand, and analytic and relational modes on the other - see Figure 1). They were able to conclude that:

> "Correlations among the cognitive style (sic) indicate that descriptive (read analytic) style was a bi-polar factor with respect to both categorical and relational style, while categorical and relational styles were indpendent of each other." (Op.cit., p. 68).

Table 17

T-Tests for Rural-Urban Differences, Controlling for Ethnicity, Sex, and Sex Within Ethnicity (one-tailed criterion)

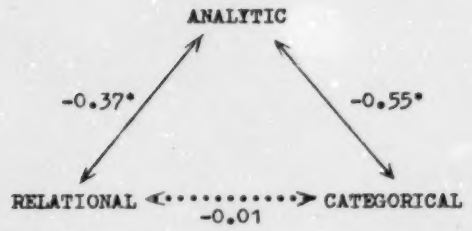
Group	Urban N	Urban Mean	Urban S.D.	Rural N	Rural Mean	Rural S.D.	t
Relational Responses							
All	245	11.029	5.612	330	12.573	5.530	3.29**
Pakeha	167	10.868	5.512	201	12.562	5.728	2.87**
Maori	78	11.372	5.842	129	12.589	5.229	1.55
Male	102	10.618	5.499	148	12.331	5.730	2.36**
Female	127	10.937	5.601	157	13.057	5.180	3.31**
Pakeha Male	67	10.388	5.419	94	12.202	5.940	1.98*
Pakeha Female	89	10.697	5.392	97	13.010	5.529	2.88**
Maori Male	35	11.057	5.703	54	12.555	5.392	1.25
Maori Female	38	11.500	6.101	60	13.133	4.604	1.50
Analytic Responses							
All	245	5.943	4.186	330	4.973	3.782	2.91**
Pakeha	167	5.946	3.918	201	4.995	3.881	2.33*
Maori	78	5.936	4.735	129	4.938	3.635	1.60(+)
Male	102	6.578	4.539	148	5.385	3.973	2.23*
Female	127	5.606	3.949	157	4.350	3.281	2.93**
Pakeha Male	67	6.298	4.214	94	5.702	4.325	0.87
Pakeha Female	89	5.910	3.789	97	4.299	3.345	3.08**
Maori Male	35	7.114	5.126	54	4.833	2.880	2.40(+)**
Maori Female	38	4.895	4.267	60	4.433	3.201	0.61
Categorical Responses							
All	245	8.004	4.135	330	7.424	3.867	1.73*
Pakeha	167	8.192	4.298	201	7.418	4.138	1.795*
Maori	78	7.603	3.757	129	7.434	3.416	0.33
Male	102	7.794	3.651	148	7.284	3.970	1.03
Female	127	8.394	4.424	157	7.535	3.830	1.75*
Pakeha Male	67	8.313	3.955	94	7.107	4.089	1.87*
Pakeha Female	89	8.371	4.473	97	7.639	4.245	1.14
Maori Male	35	6.800	2.774	54	7.593	3.770	<0(+)
Maori Female	38	8.448	4.366	60	7.367	3.070	1.33(+)

* $p < 0.05$
** $p < 0.01$

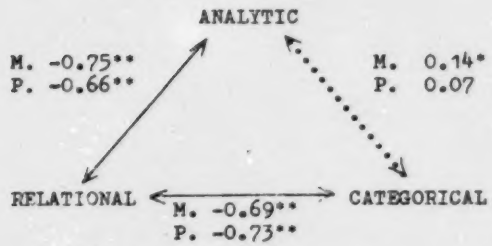
(+) Separate variance estimate, otherwise pooled variance estimate.

Figure 1

Correlation Coefficients Between Cognitive Style Respones, Comparing Gray & Knief (1975) Findings with the Present Sample



(a) Gray and Knief (1975), Table 2, p.69.



(b) The New Zealand Sample used in this Study.

M. = Maori sub-sample,

P. = Pakeha sub-sample.

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* $p < 0.05$
** $p < 0.01$

As shown in Figure 1, there is a much reduced correlation between categorical and analytic styles for New Zealand school children (non-significant in the case of European pupils), together with strong correlations between categorical and relational on the one hand, and between analytic and relational on the other, for both Maori and European pupils. From these results one can conclude that relational style was bi-polar with respect to both categorical and analytic styles, while categorical and analytic styles were independent of each other. The point here is that qualitative aspects of cognition - as measured by such instruments as the Kagan, Moss & Sigel Conceptual Style Test, which, according to Wachtel (1968), is a measure of stylistic preference rather than a measure of an ability to form conceptual classes - are likely to be strongly influenced by cultural differences. The basic differences observable amongst the cognitive style categories between children from the American south-west, and this New Zealand sample, indicates either basic differences in socialisation processes in the two countries, or rather different cognitive environments provided by the schools in the American south-western city compared with the schools involved in this study. If it is true that child rearing practices in New Zealand are rather different for the Maori population than for the Europeans, as claimed by Ritchie & Ritchie (1970), and since the two New Zealand samples are more similar to each other than either is to the American sample, in terms of the relationships among the cognitive styles, it would seem plausible to suggest that school environments have a strong influence on preferred modes of cognition, strong enough perhaps, to overcome any differences that may have arisen from differences in socialisation due to ethnicity.

APPENDIX 1

Cognitive Style Test

INSTRUCTIONS: FOR INDIVIDUAL APPLICATION
OF THE COGNITIVE STYLE TEST

Have the pictures ready for presentation, and fill in the top of the answer record as follows:-

1. Name
2. Age - add the date of birth above this
3. Class - room number
4. School
5. Put today's date in top left hand corner.

THEN SAY:

* I am going to show you some pictures arranged in groups of three, which
* are pictures of many familiar things. For each set of three pictures I
* want you to pick out any two of the things which *go together, belong*
* *together* or are *related in any way,* and tell me which you have chosen.
* *Then* I want you to tell me *why* you chose those two.

At this point, using the first set of three, elicit a response from the subject and his reason for making the choice. Write the letters of the two objects in the boxes, and write in (clearly) the reason given for the choice.

THEN SAY:

* Do you understand what I want you to do?

* All you do is pick out the two things that you think go together and then tell me why you think they go together.

* Good, then let's continue.

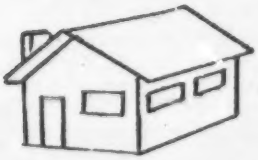
Proceed through all the pictures, cheking to see that you are writing the subjects responses in the correct place i.e. that the number on the picture coincides with the appropriate number on the answer record.

N.B.: Some children will give as reason:

1. They go together; or
2. It goes with that.

In such cases probe further by asking "why?"

1. a. b. c.



2. d. e. f.

3. a. b. c.

4. d.

e.

f.

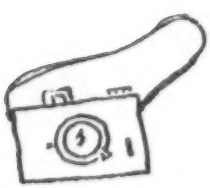
5. a.

b.

c.

6. d.

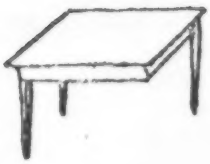
e



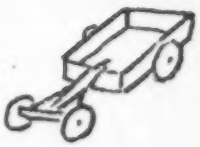
f

7 a. b. c.

8. d. e. f.

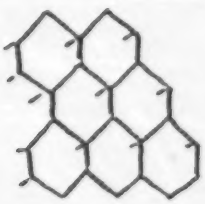


9. a. b. c.



10. d. e. f.

11. a. b. c.



12. d. e. f.

13. a.

b.

c.

14. d.

e.

f.

15. a.

b.

c.

16. d

e.

f.

17. a

b

c.

18 d.

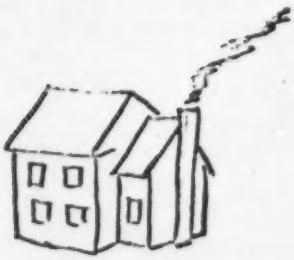
e.

f.

19. a.

b

c.



20. d.

e.

f.

21 a.

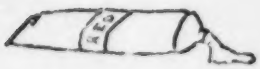
b.

c.

22. d

e.

f.

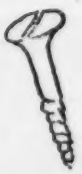


23. a.

b.

c.

24. d.



e.

f.

25. a.

b.

c.

Answer Record

MASSEY UNIVERSITY

Department of Education

Name:- _____ Age _____ yrs _____ months

Class:- _____ School:- _____

Which two go together?

1. ☐ and ☐ ..... Because _____
2. ☐ and ☐ ..... Because _____
3. ☐ and ☐ ..... Because _____
4. ☐ and ☐ ..... Because _____
5. ☐ and ☐ ..... Because _____
6. ☐ and ☐ ..... Because _____
7. ☐ and ☐ ..... Because _____
8. ☐ and ☐ ..... Because _____
9. ☐ and ☐ ..... Because _____
10. ☐ and ☐ ..... Because _____
11. ☐ and ☐ ..... Because _____
12. ☐ and ☐ ..... Because _____
13. ☐ and ☐ ..... Because _____
14. ☐ and ☐ ..... Because _____
15. ☐ and ☐ ..... Because _____
16. ☐ and ☐ ..... Because _____
17. ☐ and ☐ ..... Because _____
18. ☐ and ☐ ..... Because _____
19. ☐ and ☐ ..... Because _____
20. ☐ and ☐ ..... Because _____
21. ☐ and ☐ ..... Because _____
22. ☐ and ☐ ..... Because _____
23. ☐ and ☐ ..... Because _____
24. ☐ and ☐ ..... Because _____
25. ☐ and ☐ ..... Because _____

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